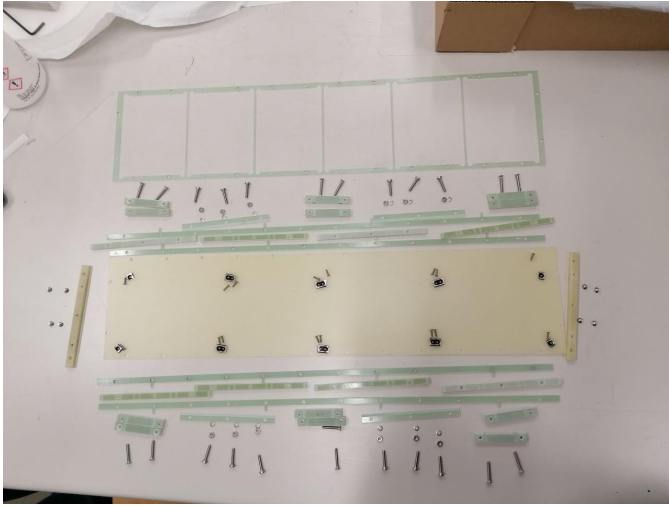


Supercell and module assembly for ProtoDUNE run 2 @ Milano-Bicocca: lessons learned

C. Brizzolari, C. Cattadori, C. Massari, L. Meazza
14/11/2022

Mechanical and assembly issues of the single SC



G10 pieces: 42

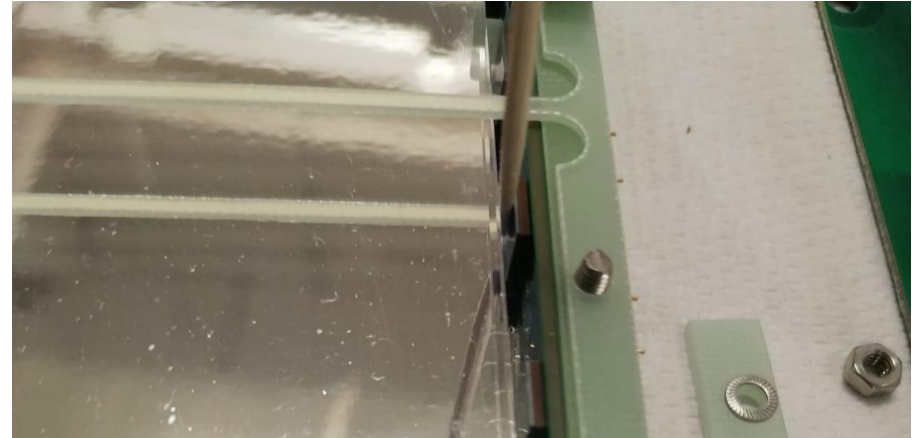
Screws: 48 (of 4 types)

Washers: 12-20

Nuts: 12

**Total: 114-122 → ~ 1:30/2:00 h of assembly
(if the operator is fast and the Vikuiti is
already in place, else ~3 h)**

Vikuiti: 60 stickers, 2 big and 58 small



At least **1 mm gap at room temperature** between G2P WLS bar and HPK SiPMs → **it increases at cold (~2 mm).**

Shrinking of G2P WLS bar: 8.3‰ (lower limit).

Shrinking of the frame: with our method it wasn't observable/measurable.

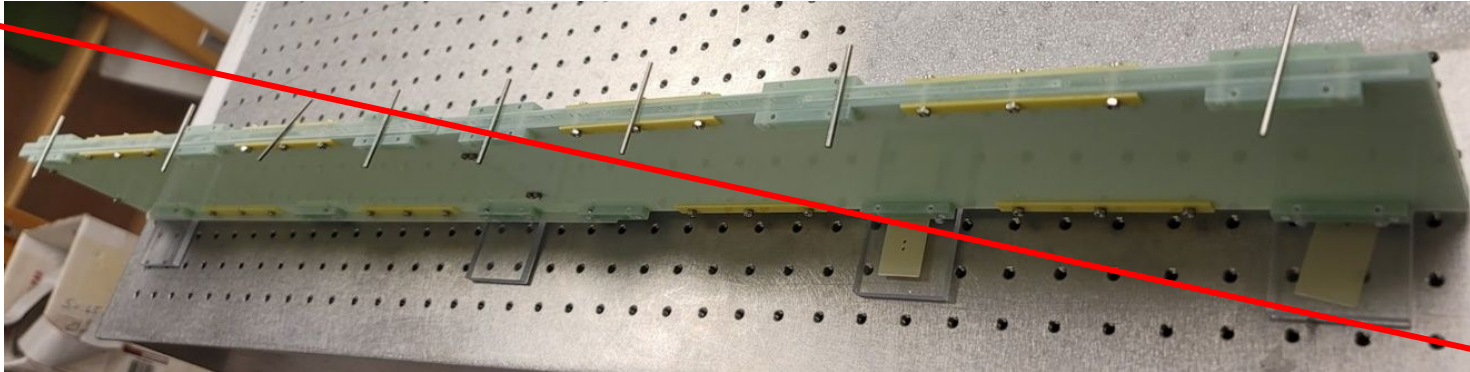
Mechanical and assembly issues of the single SC: proposed solutions

Main Recommendation: Drastically Reduce ($\frac{1}{2}$ - $\frac{1}{3}$) the overall number of G10 pieces and screws/fasteners

1. A single frame or 2 long pieces to hold the dichroics instead of 10, less screws (from 24 to ???);
2. Threaded holes to avoid the 12 nuts and 12 washers;
3. No SiPM spacer blocks (no need);
4. WLS bar dimensions revisited, in order to have optical contact at least a room temperature and smaller gap at cold;
5. 2 long G10 pieces instead of 8 for the SiPMs motherboards (SMBs);
6. If still possible,
 - a. back spring loading of SiPMs against WLS bars;
 - b. reduce number of pins on SMBs (easier Routing Boards plugging);
 - c. increase pins diameter (less fragile)

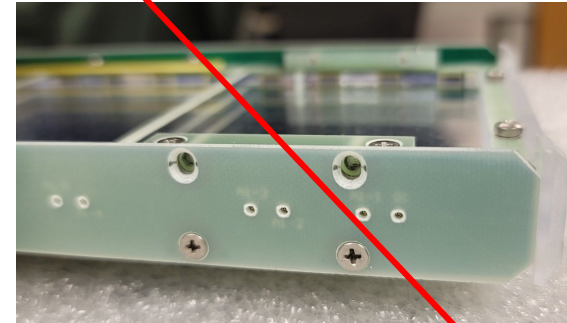
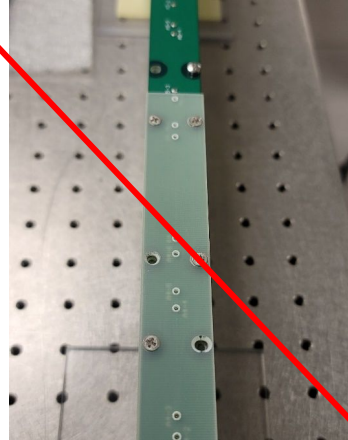
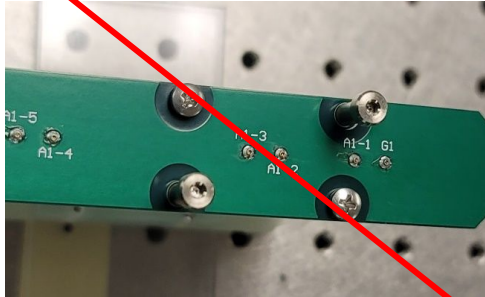
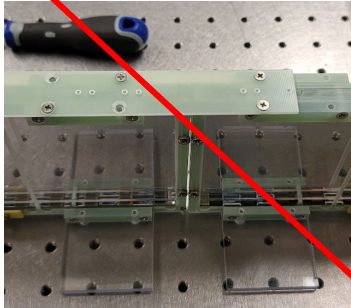
Mechanical and assembly issues of the full module and proposed solutions

- Full module assembly procedure (as described in the module assembly procedure document, rev. 28 April 2022 → ~1 day, ~5 people, one module assembled) to be heavily revised:
 - proposed: horizontal instead of vertical. Half module & RB installation with long stand piece below (e.g a long plank, 2-3 cm thick) → no need for 6-8 gage pins, stand plates, and it is possible to view from top and assemble while sitting;



Mechanical and assembly issues of the full module and proposed solutions

- Full module assembly procedure (as described in the module assembly procedure document, rev. 28 April 2022 → ~1 day, ~5 people, one module assembled) to be heavily revised:
 - No need to screw ALL the screws of the RBs for each passage (in the procedure document routing boards screws were screwed and unscrewed no less than 7 times)



Mechanical and assembly issues of the full module and proposed solutions

- Power tools allowed to make the module assembly faster
- Working area with proper light → no documented effects of white light for short period of time on WLS bars